

sol), Yamamoto et al EPO 0 646 336, Haraga et al EPO 0 613 048, Ohya EPO 0 594 973, Taguchi EPO 0 679,935.

(5) Absorbing dyes can absorb infrared radiation, as described by Proehl et al EPO 0 251 282, Parton et al EPO 0 288 076, and Japanese Patent Application JA 62/123454. Further infrared absorbing dyes are described in Parton et al U.S. Patent 4,933,269 (cyanines with carbocyclic ring in bridge), Hall et al U.S. Patent 5,245,045 (heptamethine oxonols), Harada EPO 0 568 857. Particular infrared absorbing dyes include those of the cyanine type with indole nuclei such as described in West et al U.S. Patent 5,107,063, Laganis et al U.S. Patent 4,882,265, Harada et al EPO 0 430 244, Parton et al EPO 0 288 076, Delprato et al EPO 0 523 465, Delprato et al EPO 0 539 786 (indolotri-carbocyanines with bridge amine substituents) and Harada EPO 0 568 022. Other patents of interest are: Kiekens et al 5,420,281, Kiekens et al U.S. Patent 5,362,612, Fabricius et al U.S. Patent 5,397,690, Inagaki U.S. Patent 5,310,630, Katoh et al U.S. Patent 5,326,686, Biavasco et al EPO 0 655 645, and Callant et al EPO 0 586 749.

(6) Absorbing dyes having specific substituents intended to assist in their removal during processing by solubilization, oxidation or other methods, are described in Yagihara et al U.S. Patent 4,923,789, Harder et al U.S. Patent 5,158,865, Karino et al U.S. Patent 5,188,928, Kawashima et al EPO 0 409 117 (particular amido, ureido and the like solubilizing groups), Matsushita EPO 0 508 432 and Mooberry et al WO 92/21064. Other patents of interest are: Karino U.S. Patent 5,278,037, Kiekens et al U.S. Patent 5,344,749, Kiekens et al U.S. Patent 5,380,634, Taguchi EPO 0 679 935, Kiekens et al EPO 0 675 403.

(7) Various other azo type dyes are described in Matejec et al U.S. Patent 5,108,883 (azomethines), Jimbo U.S. Patent 5,155,015 (aryloxazolinones or arylazobutenolides), Motoki et al U.S. Patent 5,214,141 (azomethines with N-aryl substituents and cyclic amino group), Yamazaki U.S. Patent 5,216,169 (hydroxypyrideneazomethines) and Fabricius WO 93/13458 (diketo diazo dyes).

(8) Other absorber dyes are described in Masukawa et al U.S. Patent 4,788,284 (diphenylimidazoles), Ohno et al U.S. Patent 4,920,031 (pyridone oxonols), Shuttleworth et al U.S. Patent 4,923,788 (furanones), Kuwashima et al U.S. Patent 4,935,337 (pyridone oxonols), Carlier et al U.S. Patent 5,187,282 (xanthene derivatives), Loer et al EPO 0 329 491 (trinuclear cyanine with methine bridge having acidic nucleus of type in oxonol or merocyanine dyes), Usagawa et al EPO 0 342 939 (indoloxanines with acid solubilizing groups on back rings), Adachi et al EPO 0 366 145 (pyrazoloazoles), Suzuki et al EPO 0 518 238 (pyrazolotriazoles), Usagawa et al EPO 0 521 664 (silver salts of various dyes), Hirabayashi et al EPO 0 521 668 (silver salts of various dyes), Kawashima et al EPO 0 521 711 (silver salts of pyrimidine containing compounds) and Hall EPO 0 552 010.

(9) Absorbing dyes or dye combinations used to obtain absorption at particular wavelengths, manner of incorporating them in a photographic element, or absorbing dyes plus other components, are described in Ailliet et al U.S. Patent 4,770,984 (localization of absorber dyes), Szajewski U.S. Patent 4,855,220 (dye absorbing in region to which layer underneath is sensitized), Toya et al U.S. Patent 5,147,769 (dye in oil droplet dispersion or polymer latex), Stockel et al U.S. Patent 5,204,231 (absorber dye combinations for various wavelengths of absorption), Schofield et al U.S. Patent 5,372,922 (polymeric ultraviolet absorbers loaded with high boiling organic solvents), Toda et al U.S. Patent 5,393,648 (filter dyes dispersed with high molecular weight condensation polymers), Okada et al EPO 0 319 999 (yellow absorber dye plus colloidal silver), Harada et al EPO 0 412 379, Ohno et al EPO 0 445 627 (dye combinations), Karino EPO 0 456 163 (location and dye amounts), Murai et al EPO 0 510 960, Kawai et al EPO 0 539 978. Other patents of interest are: Bowne U.S. Patent 5,298,377, Nakagawa et al U.S. Patent 5,348,846, Sasai et al U.S. Patent 5,401,620, Adin et al U.S. Patent 5,298,379, Heremans EPO 0 681 209, Ailliet et al EPO 0 582 000, Iwasaki et al EPO 0 690 342, Slater et al EPO 0 646 839, and Roland et al EPO 0 666 500.

C. Discharge

The materials can be discharged (i.e., decolorized or solubilized) in photographic processing solutions (e.g., alkaline, bleaching and/or fixing solutions) or by alkaline vapor, heat or light processing as illustrated by Altman U.S. Patent 3,269,839, Mitchell U.S. Patent 3,619,194, Wiese et al U.S. Patent 3,769,019, Heselbine et al U.S. Patent 3,745,009 (Reissue 29,168) and Sturmer U.S. Patent 3,984,248.

IX. Coating physical property modifying addenda

A. Coating aids

(1) The photographic element layers can contain various types of coating aids (e.g., wetting agents) such as anionic, cationic, nonionic or zwitterionic surfactants, alone or in combination. Some useful coating aids are saponin; alkylamine oxides as described in Knox U.S. Patent 3,607,291; sulfonated alkylaryl polyethers as illustrated by Baldisiefen U.S. Patent 2,600,831, Knox et al U.S. Patents 2,719,087 and 3,026,202, Sakamoto et al U.S. Patent 4,192,683 and Nishio et al U.S. Patent 3,415,649; alkylene glycol ethers of polyhydric alcohols as disclosed by Swan et al U.S. Patent 2,240,469, Swan U.S. Patent 2,240,472, Knox et al U.S. Patent 2,831,766, Seidel et al U.S. Patent 3,409,435, Eisenman et al U.S. Patent 3,442,654, Knox U.S. Patent 3,514,293, Padday U.S. Patent 3,516,844, Gantz et al U.S. Patent 3,617,292, Wagner et al U.K. Patent 774,806, U.K. Patent 1,022,878 and Milton U.K. Patent 1,201,054; amphoteric compounds as described in McQueen U.S. Patent 2,197,809, Chilton U.S.

Patent 2,368,287, Gates U.S. Patent 2,824,015, Swan U.S. Patent 2,240,471, Knox et al U.S. Patents 2,992,108, 3,091,623, 3,169,870 and 3,306,749, Harriman U.S. Patent 3,018,178, Ben-Ezra U.S. Patent 3,133,816, Wolf et al U.S. Patent 3,408,193, Nishio et al U.S. Patents 3,441,413 and 3,545,974, Sato et al U.S. Patent 3,475,174, Knox U.S. Patent 3,506,449, Gantz et al U.S. Patent 3,563,756, Kalenda U.S. Patent 3,573,049, Mackey U.S. Patent 3,619,199, Yamamoto et al U.S. Patents 3,726,683 and 3,843,368; carboxyalkyl-substituted polyglycol ethers and esters as described in Ville et al U.S. Patent 3,663,229; various types of monoesters derived from polyhydroxy compounds as disclosed in Boomer U.S. Patent 2,190,645, Swan U.S. Patent 2,240,470, Simmons U.S. Patent 2,240,475, Swan et al U.S. Patent 2,353,279, Knox et al U.S. Patent 3,220,847, Hagge et al U.S. Patent 3,516,833 and U.K. Patent 1,012,495; fluoro-substituted compounds as illustrated by McDowell U.S. Patent 3,589,906, Groh et al U.S. Patent 3,666,478, Babbitt et al U.S. Patent 3,775,126, Bailey et al U.S. Patent 3,850,642, Habu et al German OLS 2,610,485, U.K. Patent 1,439,402, and Cruikshank et al, *Research Disclosure*, Vol. 166, February, 1978, Item 16630; imidazoles as illustrated by Mackey U.S. Patent 2,982,651 and Knox U.S. Patent 3,539,352; maleo-pimarates, optionally in combination with an acetylenic ethylene oxide derivative or a sucrose ester of an aliphatic acid, as disclosed in Knox et al U.S. Patent 2,823,123, Wilson et al U.S. Patent 3,041,171 and Knox U.S. Patents 3,437,485 and 3,564,576; maleic ester amides as illustrated in Kamio U.S. Patent 4,547,459; the sodium salt of the condensation product of naphthalene sulfonic acid and formaldehyde as illustrated in Salminen et al U.S. Patent 3,062,649; phosphate esters of glycidol polyethers as disclosed in Mackey U.S. Patent 3,725,079; poly(dimethylsiloxane) as described in Hughes et al U.S. Patent 3,885,965; long-chain sucrose ethers or urethanes as illustrated by Nishio et al U.S. Patent 3,507,660; higher alcohol sulfates, water-soluble (sulfo) salts of the aliphatic esters of sulfosuccinic acid, fatty acid esters of hydroxyalkyl sulfonic acid, amide and ester derivatives of sulfoacetic acid, alpha-sulfo lower alkyl esters of 7 to 18 carbon atom fatty acids and sulfate ester products of a glycidol polyether as described in Baldisiefen U.S. Patent 2,203,768, Simmons et al U.S. Patent 2,240,476, Harsh et al U.S. Patent 2,447,462, Knox et al U.S. Patents 3,068,101 and 3,201,252, Mackey et al U.S. Patent 3,516,835, Mackey U.S. Patent 3,725,080, Pollet et al U.S. Patent 3,793,032, Ishihara et al U.S. Patent 3,824,102 and *Research Disclosure*, Vol. 160, August, 1977, Item 16040; sulfoxides as described by Herz, *Research Disclosure*, Vol. 129, September, 1975, Item 12927; combinations of alkyl sulfate surfactants and N-acyl sarcosinate surfactants as disclosed in Cruikshank et al U.S. Patent 4,370,412; taurines as disclosed by Knox et al U.S. Patents 2,739,891 and 3,165,409 and Ben-Ezra U.S. Patent 3,042,522. These and other suitable coating aids are disclosed in

McCutcheons's Detergents and Emulsifiers, Allured Publishing Corp., 1973.

(2) Relatively recent coating aids, surfactants and dispersing agents, including anionic, nonionic and cationic materials are described in Furlan et al U.S. Patent 5,037,729, Cavallo et al U.S. Patent 5,098,821, Ashida et al U.S. Patent 5,008,150, Toya (et al) U.S. Patents 4,916,049 and 4,920,032, Yoneyama et al U.S. Patent 4,916,054, Pitt et al U.S. Patents 4,968,599 and 4,988,610 and WO 91/18321, Briggs et al U.S. Patent 4,892,806, Ishigaki U.S. Patent 5,208,139, Yoneyama et al U.S. Patent 5,221,603, Uesawa et al U.S. Patent 4,762,776, Orem U.S. Patent 5,411,844, Fujita et al U.S. Patent 5,415,986, Orem U.S. Patent 5,418,128, Endres et al German OLS 3,835,077, Mochizuki et al EPO 0 556 002, Fukazawa et al EPO 0 306 246, Takada et al EPO 0 567 083, Tachibana et al EPO 0 361 138, Orem EPO 0 549 496, Ueda et al EPO 0 643 327 and Vandenaabeele EPO 0 644 455.

B. Plasticizers and lubricants

(1) The flexibility of the silver halide emulsion and other hydrophilic colloid-containing layers of the elements upon drying can be improved through the incorporation of plasticizers. Representative plasticizers include alcohols, dihydric alcohols, trihydric alcohols and polyhydric alcohols, acid amides, cellulose derivatives, lipophilic couplers, esters, phosphate esters such as tricresyl phosphate, glycol esters, diethylene glycol mixed esters, phthalate esters such as dibutyl phthalate and butyl stearate, tetraethylene glycol dimethyl ether, ethyl acetate copolymers, lactams, lower alkyl esters of ethylene bis-glycolic acid, ether esters or diesters of an alkylene glycol or a polyalkylene glycol, polyacrylic acid esters, polyethylene imines, poly(vinyl acetate) and polyurethanes, as illustrated by Eastman et al U.S. Patent 306,470, Wiess U.S. Patent 3,635,853, Milton et al U.S. Patent 2,960,404, Faber et al U.S. Patent 3,412,159, Ishihara et al U.S. Patent 3,640,721, Illingsworth et al U.S. Patent 3,003,878, Lowe et al U.S. Patent 2,327,808, Umberger U.S. Patent 3,361,565, Gray U.S. Patent 2,865,792, Milton U.S. Patents 2,904,434 and 2,860,980, Milton et al U.S. Patent 3,033,680, Dersch et al U.S. Patent 3,173,790, Fowler U.S. Patent 2,772,166 and Fowler et al U.S. Patent 2,835,582, VanPaesschen et al U.S. Patent 3,397,988, Balle et al U.S. Patent 3,791,857, Jones et al U.S. Patent 2,759,821, Ream et al U.S. Patent 3,287,289 and DeWinter et al U.S. Patent 4,245,036.

(2) The photographic elements can contain lubricants to reduce sliding friction encountered in use. Representative lubricants which can be used in photographic elements include long-chain fatty acids, alkali salts of sulfonated castor oil, alkaline earth metal salts of higher aliphatic carboxylic acids, monohydric and dihydric alcohols, ethers, primary amides, hydroxyalkyl amine fatty acid condensates, esters, polyesters, sperm-oil products, polysaccharide derivatives, polytetrafluoro-ethylene particles, colloidal silica, silicone derivatives, poly-

meric silicone compounds plus δ -alanine-derivative surfactants, mixtures of an alkyl silicone and an aryl silicone, phosphate triesters, alkali metal salts of alkylphosphoric acid esters, poly(methyl methacrylate) beads, betaines, acyl alkyl taurines and paraffins and waxes such as carnauba wax, as illustrated by Guestaux et al U.S. Patents 3,082,087 and 3,658,573, Robijns U.S. Patent 2,588,765, Nellist et al U.K. Patent 1,263,722, Harriman U.S. Patent 3,018,178, Brown et al U.K. Patents 1,320,564 and 1,320,757, Duane U.S. Patent 3,121,060, DeBoer et al, Research Disclosure, Vol. 139, November, 1975, Item 13907, Mackey et al U.S. Patent 3,870,521, Stephens U.S. Patent 3,679,411, McGraw U.S. Patent 3,489,567, Ben-Ezra U.S. Patent 3,042,522, U.K. Patent 955,061, Tallet et al U.S. Patent 3,080,317, Earhart et al U.S. Patent 3,516,832, Knox et al U.S. Patent 2,739,891, Secrict et al U.S. Patent 3,295,979, Nadeau et al U.S. Patent 3,222,178 and Guestaux French Patent 2,180,465, Shibue et al U.K. Patent Application 2,027,221, Naoi et al U.S. Patent 4,232,117 and Sugimoto et al U.S. Patent 4,675,278.

(3) Yoneyama et al U.S. Patent 5,063,147, Takeuchi U.S. Patent 5,019,491 Shiba et al U.S. Patent 4,866,469, Geiger et al U.S. Patent 5,288,602 and Miyamoto EPO 0 668 534 represent relatively recent publications relating to plasticizers and lubricants.

C. Antistats

(1) The photographic elements can contain conducting layers such as antistatic layers. Such layers can contain soluble salts such as chloride, nitrate and similar water soluble salts; conductive metals such as evaporated metals; conductive carbon as illustrated by Simmons U.S. Patent 2,327,828, insoluble inorganic salts such as those described by Trevoy U.S. Patents 3,245,833 and 3,428,451, and polymers having ionic groups as illustrated by Minsk U.S. Patent 2,861,056, Sterman et al U.S. Patent 3,206,312, Babbitt et al U.S. Patent 3,775,126, Trevoy U.S. Patents 3,963,498, 4,025,342, 4,025,463, 4,025,691 and 4,025,704, Smith U.K. Patent 1,466,600, Kelley et al Research Disclosure, Vol. 158, June, 1977, Item 15840, Campbell et al Research Disclosure, Vol. 162, October, 1977, Item 16258, and Mecca Research Disclosure, Vol. 166, February, 1978, Item 16630, combinations of inorganic salts and compounds comprising poly-alkylene oxides as illustrated by Kishimoto U.S. Patent 4,272,616, Chen et al U.S. Patents 4,582,781 and 4,610,955, and Japanese Patent Application JA 62/293,241, polyalkylene oxide-substituted polyphosphazenes as illustrated by Japanese Patent Application JA 62/286,038, and combinations of complexes of polyalkylene oxide-substituted polyphosphazenes, as illustrated by Chen et al EPO 0 304 296 and Japanese Patent Application 62/286,038.

(2) Undesirable static discharges during manufacture, exposure and processing of photographic materials can also be controlled by modification of the surface-charging characteris-

tics of the emulsion or backing. Matting agents can reduce the electrostatic charging by reducing the effective area of surface making contact. Surfactants of various kinds and combinations can also be employed as illustrated by Defeest et al U.S. Patent 3,754,924, Bailey et al U.S. Patents 3,850,642 and 3,888,678, Babbitt et al U.S. Patents 3,775,126, 3,850,640 and 4,013,696; and U.K. Patent GB 1,330,356.

(3) Because most of the radiation from static electrical discharges is in the ultraviolet range, the photographic material can be protected from static exposure by the use of such UV-absorbing materials as yellow antihalation dyes and specific UV absorbers. The UV-absorbing materials can already be in place for purposes of antihalation or improved color rendition as described in Section VIII of this disclosure, or can be added for static protection as illustrated by Kondo et al German OLS 2,163,904.

(4) Relatively recent publications relating to anti-static agents and their use in photography are illustrated by Timmerman et al U.S. Patent 4,828,927, Vallarino U.S. Patent 4,863,801, Cho U.S. Patent 4,891,308, Aizawa et al U.S. Patent 4,895,792, Tachibana et al U.S. Patent 4,898,808, Besio et al U.S. Patent 4,914,018, Mukunoki et al U.S. Patent 4,917,993, Gundlach U.S. Patent 4,940,655, Chen et al U.S. Patent 4,948,720, Tachibana et al U.S. Patent 4,956,270, Cho U.S. Patent 4,960,687, Chen et al U.S. Patent 4,971,897, Cavallo et al U.S. Patent 4,975,363, Fujita et al U.S. Patent 4,978,602, Kuwabara et al U.S. Patent 4,999,276, Yamada et al U.S. Patent 5,004,669, Anderson et al U.S. Patent 5,006,451, Van Thillo et al U.S. Patent 5,008,178, Tsukada U.S. Patent 5,013,637, Mukunoki et al U.S. Patent 5,028,516, Cho et al U.S. Patent 5,077,185, Tachibana et al U.S. Patents 5,079,136, 5,084,339, 5,094,909 and 5,098,822, Shibata et al U.S. Patent 5,108,884, Beisswenger et al U.S. Patent 5,128,233, Takamuki et al U.S. Patent 5,135,843, Ueda et al U.S. Patent 5,137,802, Hirabayashi et al U.S. Patent 5,153,113, Yasunami et al U.S. Patent 5,153,115, Nagasaki et al U.S. Patent 5,173,396, Ueda et al U.S. Patent 5,209,985, Anderson et al U.S. Patent 5,221,598, Saverin et al U.S. Patent 5,232,824, Carlson U.S. Patent 5,236,818, Huffman U.S. Patent 5,238,706, Hosoi et al U.S. Patent 5,238,800, Ishigaki et al U.S. Patent 5,238,801, Bowman et al U.S. Patent 5,244,728, Tachibana et al U.S. Patent 5,284,741, Yamanouchi et al U.S. Patent 5,300,416, Melpolder et al U.S. Patent 5,308,687, Stimson et al 5,326,688, Anderson et al U.S. Patent 5,340,676, Carlson U.S. Patent 5,344,751, Quintens et al U.S. Patent 5,354,613, Havens et al U.S. Patent 5,356,468, Anderson et al U.S. Patent 5,360,706, Shiratsuchi et al U.S. Patent 5,362,613, Jones et al U.S. Patent 5,366,544, Anderson et al U.S. Patent 5,366,855, Christian et al U.S. Patent 5,368,995, Kurachi et al U.S. Patent 5,372,923, Quintens et al U.S. Patent 5,372,924, Kurachi et al U.S. Patent 5,376,517, Muys et al U.S. Patent 5,391,472, Morrison et al U.S.

Patent 5,427,835, Boston et al U.S. Patent 5,439,785, Fornasari et al U.S. Patent 5,441,860, Krafft et al U.S. Patent 5,443,944, Ubel et al EPO 0 250 154, Yoneyama et al EPO 0 288 059, Van Gossum et al EPO 0 296 656, Hesse et al EPO 0 319 951, Tachibana et al EPO 0 391 402, Habu et al EPO 0 409 665, Arai et al EPO 0 416 867, Tachibana et al EPO 0 430 110, Van Thillo et al EPO 0 444 326, Ito et al EPO 0 452 102, Araki et al EPO 0 476 429, Wada et al EPO 0 476 453, Valsecchi et al EPO 0 486 982, Milner EPO 0 504 826, Timmerman et al EPO 0 505 626, Coltrain et al EPO 0 509 327, Yamauchi et al EPO 0 511 764, Boston et al EPO 0 531 006, Vandenabelle EPO 0 534 006, Ito et al EPO 0 552 617, Kurachi et al EPO 0 569 821, Valsecchi et al EPO 0 589 329, Bayless et al EPO 0 631 178, Furlan et al EPO 0 633 496, Vandabeele EPO 0 644 456, Gardner EPO 0 646 837, Ballerini et al EPO 0 647 879, Tsuji EPO 0 652 469, Valsecchi et al EPO 0 655 646, Taguchi EPO 0 660 174, Cawse U.K. Patent Application 2 246 870, Eitle DE 41 03 437, Melpolder et al WO 90/13851, Araki et al EPO 0 476 429, Anderson et al WO 91/18061 and WO 91/18062, Robert WO 93/06040, Tixier et al WO 93/06043 and Bennett et al WO 94/13477.

D. Matting Agents

(1) The layers of the photographic elements can contain matting agents for such purposes as prevention of blocking and ferrotyping, reduction of static charging and excessive sheen, physical durability, pencil acceptance, improved air release during vacuum drawdown and avoidance of Newton's rings. Finely divided inorganic particles such as various forms of silica, barium and calcium sulfates, zinc and titanium oxides, desensitized silver halide and zinc carbonate, dispersed in natural and synthetic vehicles, can be employed as illustrated by Robijns U.S. Patent 2,192,241, Maynard et al U.K. Patent 1,201,905, deHaes U.S. Patent 3,257,206 Nadeau U.S. Patent, 3,437,484 Himmelmann et al U.S. Patent 3,322,555, Whitmore et al U.S. Patent 3,411,907, Noede U.S. Patent 3,353,958, Hasenauer et al U.S. Patent 3,370,951, Takenaka et al U.S. Patent 3,615,554, U.K. Patent 1,260,772, Oshibuchi et al U.S. Patent 3,635,714, Verburg U.S. Patent 3,769,020, Secrist et al U.S. Patent 4,029,504, Nagatomo et al U.S. Patent 4,021,245 and German OLS 2,529,321, Yutzy et al U.K. Patent 760,775, Byerley et al U.S. Patent 3,523,022 and Salminen et al U.S. Patent 3,062,649.

(2) Finely divided organic particles or beads can be similarly used as matting agents, such as calcium organic salts, starches--including starch esters, flours, arrowroot, india rubber, talc, hardened deionized or deashed gelatin, zein and polymeric materials--including various forms of cellulose and polymers or copolymers of α , β -ethylenically unsaturated mono- and di-carboxylic acids, esters and half-esters and their sulfonic acid analogues (particularly acrylic and methacrylic acids and their methyl esters), styrene, acrylonitrile and fluorinated ethylenes, as well as polycarbonate and poly(vinyl alcohol), as

illustrated by Jelley U.S. Patent 1,939,213, Knoefel U.S. Patents 2,221,873 and 2,268,662, Lindquist U.S. Patent 2,322,037, Plakunov U.S. Patent 3,591,379, Potter et al U.S. Patent 2,376,005, Jelley et al U.S. Patent 2,992,101, Minsk et al U.S. Patent 2,391,181, Lynn U.S. Patent 2,701,245, Barhart et al U.S. Patent 3,516,832, Morcher et al U.S. Patent 3,079,257, Grabhoefer et al U.S. Patent 3,443,946, Klockgether et al U.S. Patent 3,262,782, U.K. Patent 1,055,713, De Geest et al U.S. Patent 3,754,924 and Hutton U.S. Patent 3,767,448. Vinyl chloride polymers or copolymers can be used as illustrated by Roth et al U.K. Patent 2,033,596, copolymers of fluorinated monomers and silicon-containing monomers as described in Japanese Patent Application JA 62/17744, and copolymers of maleic anhydride and olefins as illustrated by Brück et al U.S. Patent 4,287,299. The matte can consist of inorganic particles coated with an organic polymer as illustrated by Thijs et al U.S. Patent 4,235,959, of layered polymer particles, as illustrated in Japanese Patent Application JA 62/17742, or polymers coated with fluorine compounds, as illustrated in Japanese Patent Application JA 61/230136. The particle surfaces can be linked to gelatin, as illustrated by Bagchi et al EPO 0 307 855.

(3) The matte particles may be of a range of sizes and of various shapes, for example, irregular as in the case of silica particles or spherical as in the case of many organic polymer mattes. The particles can be monodisperse as illustrated in Research Disclosure, Vol. 216, April, 1982, Item 21617. The particles can be porous, as illustrated by Naito, U.S. Patent 4,094,848. The matte particles can be pigmented or dyed, as illustrated by Heigold et al U.S. Patent 4,172,731. The particles can be process-soluble, as illustrated by Jelley et al U.S. Patent 2,992,101, Hutton U.S. Patent 3,767,448, Naito U.S. Patent 4,094,848, Vallarino et al U.S. Patent 4,447,525, Himmelmann et al U.S. Patent 4,524,131 and Japanese Patent Applications 62/14467 and 61/230136. The matte can be resistant to removal in the process, as illustrated by Ishii U.S. Patent 4,396,706. The particles can be alkali-swellable but not removable, as illustrated by Brück et al U.S. Patent 4,301,240. Combinations of process-insoluble and process-soluble matting agents can be used.

(4) Relatively recently published examples of matting agents are provided by Podszun et al U.S. Patent 5,093,445, Fautz U.S. Patent 4,980,273, Vandenabeele et al U.S. Patent 4,766,059, Grzeskowiak et al U.S. Patent 4,711,838, Lalvani et al U.S. Patent 4,940,653, Katoh et al U.S. Patent 4,952,484, Okamura et al U.S. Patent 5,057,407, Ogasawara et al U.S. Patent 5,204,233, Ishigaki et al U.S. Patent 5,206,127, Nitschke et al U.S. Patent 4,997,735, Ishigaki U.S. Patent 5,122,445, Arai et al U.S. Patent 5,070,005, Nishio et al U.S. Patent 5,252,448, Elton et al U.S. Patent 5,104,914, Sterman et al U.S. Patent 5,288,598, Sterman et al U.S. Patent 5,300,411, Takada U.S. Patent 5,352,569, Tashiro

et al U.S. Patent 5,370,982, Smith et al U.S. Patent 5,378,577, Yamashita et al U.S. Patent 5,380,637, Waterman U.S. Patent 5,415,969, Jury U.S. Patent, 5,420,006, Fornasari et al U.S. Patent 5,441,860, Kanetake et al EPO 0 567 118, Baldassarri et al EPO 0 479 029, Besio et al EPO 0 370 405, Haga et al EPO 0 350 022, Harris EPO 0 341 200, Shor EPO 0 282 171, Salvani et al EPO 0 262 504 and Bagchi EPO 0 307 855.

X. Dye image formers and modifiers

The photographic elements can be color photographic elements which form dye images through the selective destruction, formation or physical removal of dyes.

A. Silver dye-bleach

The photographic elements can produce dye images through the selective destruction of dyes or dye precursors, such as silver-dye-bleach processes, as illustrated by A. Meyer, *The Journal of Photographic Science*, Vol. 13, 1965, pp. 90-97. Bleachable azo, azoxy, xanthene, azine, phenylmethane, nitroso complex, indigo, quinone, nitro-substituted, phthalocyanine and formazan dyes as illustrated by Stauner et al U.S. Patent 3,754,923, Piller et al U.S. Patent 3,749,576, Yoshida et al U.S. Patent 3,738,839, Froehlich et al U.S. Patent 3,716,368, Piller U.S. Patent 3,655,388, Williams et al U.S. Patent 3,642,482, Gilman U.S. Patent 3,567,448, Loeffel U.S. Patent 3,443,953, Anderau U.S. Patents 3,443,952 and 3,211,556, Mory et al U.S. Patents 3,202,511 and 3,178,291 and Anderau et al U.S. Patents 3,178,285 and 3,178,290, as well as their hydrazo, diazonium and tetrazolium precursors and leuco and shifted derivatives as illustrated by U.K. Patents 923,265, 999,996 and 1,042,300, Pelz et al U.S. Patent 3,684,513, Watanabe et al U.S. Patent 3,615,493, Wilson et al U.S. Patent 3,503,741, Boes et al U.S. Patent 3,340,059, Gompf et al U.S. Patent 3,493,372, Puschel et al U.S. Patent 3,561,970, Mowrey et al U.S. Patent 4,168,170, Marthaler et al U.S. Patent 4,304,846, Mollet et al U.S. Patent 4,374,914, Lenoir et al U.S. Patent 4,379,819 and Lenoir U.S. Patent 4,575,482 can be employed. More recent developments in dye bleach applications are shown in Ohlschlager et al U.S. 4,458,009, Schadt U.S. 4,460,679, Kriebel U.S. 4,704,349, Schellenberg U.S. 4,803,151, Kuhn U.S. 4,837,133, Baettig U.S. 5,043,257 and EPO 0 351 740.

B. Image-dye-forming couplers

(1) The photographic elements can produce dye images through the selective formation of dyes such as by reacting (coupling) a color-developing agent (e.g., a primary aromatic amine) in its oxidized form with a dye-forming coupler. In one form, the dye-forming couplers are chosen to form subtractive primary (i.e., yellow, magenta and cyan) image dyes and are nondiffusible, colorless couplers, such as 2- and 4-equivalent couplers of the open-chain ketomethylene, pyrazolone,

pyrazolotriazole, pyrazolobenzimidazole, phenol and naphthol type, hydrophobically ballasted for incorporation in high-boiling organic (coupler) solvents. Such couplers are illustrated by Salminen et al U.S. Patents 2,423,730, 2,772,162, 2,895,826, 2,710,803, 2,407,207, 3,737,316 and 2,367,531, Loria et al U.S. Patents 2,772,161, 2,600,788, 3,006,759, 3,214,437 and 3,253,924, McCrossen et al U.S. Patent 2,875,057, Bush et al U.S. Patent 2,908,573, Gledhill et al U.S. Patent 3,034,892, Weissberger et al U.S. Patents 2,474,293, 2,407,210, 3,062,653, 3,265,506 and 3,384,657, Porter et al U.S. Patent 2,343,703, Greenhalgh et al U.S. Patent 3,127,269, Feniak et al U.S. Patents 2,865,748, 2,933,391 and 2,865,751, Bailey et al U.S. Patent 3,725,067, Beavers et al U.S. Patent 3,758,308, Lau U.S. Patent 3,779,763, Fernandez U.S. Patent 3,785,829, U.K. Patent 969,921, U.K. Patent 1,241,069, U.K. Patent 1,011,940, Vandenberg et al U.S. Patent 3,762,921, Beavers U.S. Patent 2,983,608, Loria U.S. Patents 3,311,476, 3,408,194, 3,458,315, 3,447,928 and 3,476,563, Cressman et al U.S. Patent 3,419,390, Young U.S. Patent 3,419,391, Lestina U.S. Patent 3,519,429, U.K. Patent 975,928, U.K. Patent 1,111,554, Jaeken U.S. Patent 3,222,176 and Canadian Patent 726,651, Schulte et al U.S. Patent 1,248,924, Whitmore et al U.S. Patent 3,227,550, Lau U.S. Patent 4,333,999, Lestina U.S. Patent 4,443,536, Booms et al U.S. Patent 4,420,556 (controlled smearing), Lau U.S. Patent 4,401,752, Bowme et al EPO 0 284 239, Kilminster et al EPO 0 271 323, Kilminster et al EPO 0 271 324, Roman et al EPO 0 285 274, Bowme et al EPO 0 284 240, Krishnamurthy WO 88/04795, Kilminster et al U.S. Patent 4,753,871 and Bailey et al U.S. Patent 4,728,598. Polymeric couplers are also useful, as described by, for example, Tang et al U.S. Patent 4,804,260, Sato et al U.S. Patent 4,540,654 and Hirano et al U.S. Patent 4,576,910.

(2) Further types of image dye forming couplers are taught in Mooberry et al U.S. Patent 4,840,884, Harder U.S. Patent 4,948,722, Kaneko U.S. Patent 4,970,142, Moore U.S. Patent 4,973,545, Kobayashi et al U.S. Patent 5,017,466, Kawagishi et al 5,021,329, Kita et al U.S. Patent 5,024,930, Lestina et al U.S. Patent 5,051,343, Lau et al U.S. Patent 5,091,291, Crawley et al U.S. Patent 5,143,821, Sato et al U.S. Patent 5,162,196, Shimada et al U.S. Patent 5,164,289, Katoh et al U.S. Patent 5,169,749, Sato et al U.S. Patent 5,206,129, Mooberry et al U.S. Patent 5,246,820, Fujita et al U.S. Patent 5,296,339, Krishnamurthy U.S. Patent 5,306,604, Krishnamurthy U.S. Patent 5,318,884, Tang et al U.S. Patent 5,340,708, Tang et al U.S. Patent 5,358,836, Tang et al U.S. Patent 5,358,837, Chen et al U.S. Patent 5,360,710, Krishnamurthy et al U.S. Patent 5,399,467, Naoki et al EPO 0 500 043, Lau et al EPO 0 523 641, Masumi et al EPO 0 531 906, Crawley et al WO 92/00299, Hubsch et al DE 4,243,784 and Bergthaller DO 4,016,418.

(3) Polymeric type couplers are disclosed in Tang et al U.S. Patent 4,804,620, Yamanouchi et al U.S. Patent 4,874,689,